Pseudomonas aeroginosa

Presented By:

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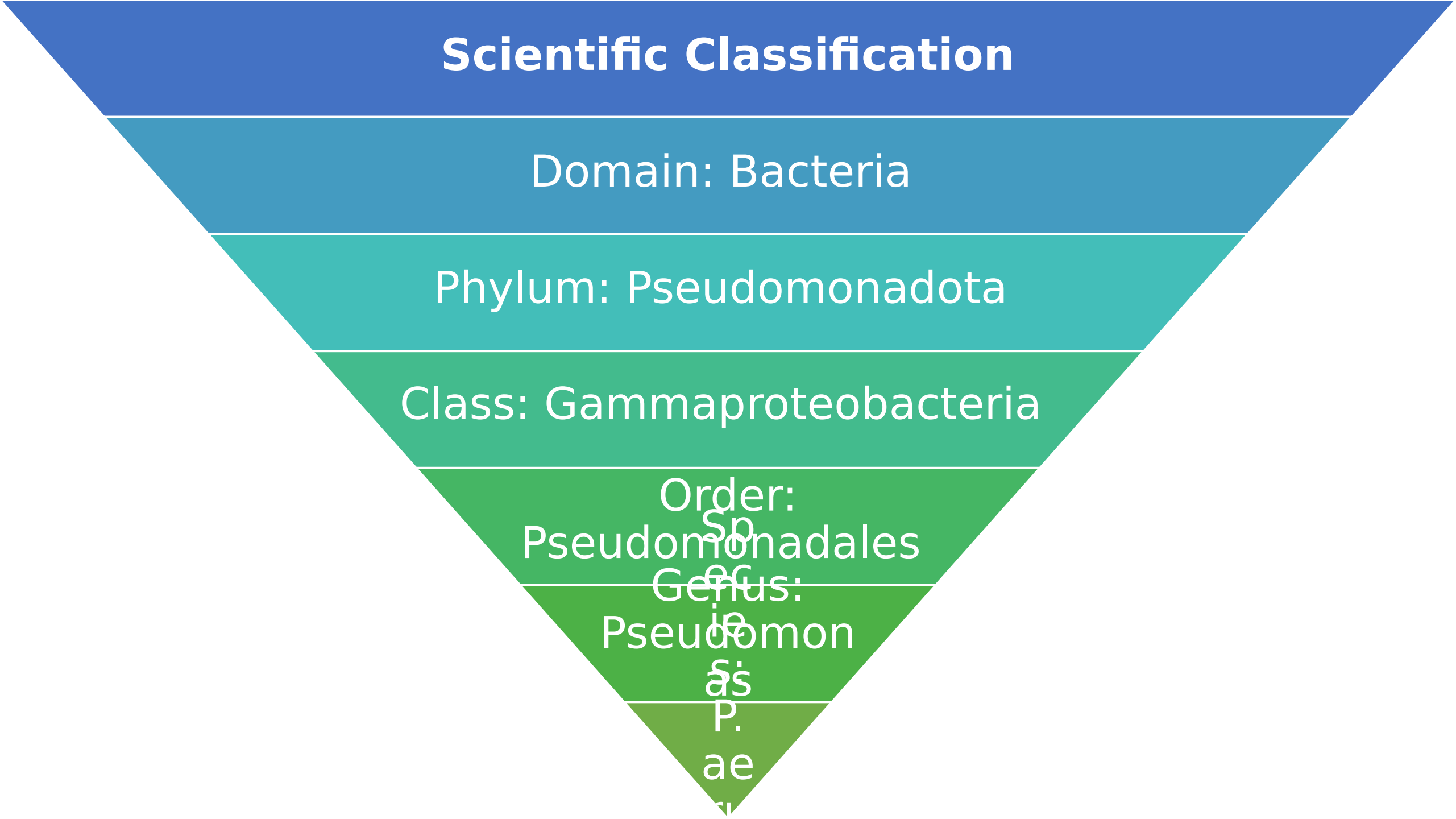
MIB 5th Semester

Introduction

- Gram-negative, rod-shaped bacterium
- Aerobic, but can be facultatively anaerobic
- Widely distributed in environment


Scientific Classification
Domain: Bacteria
Phylum: Pseudomonadota
Class: Gammaproteobacteria
Order: Pseudomonadales
Genus: Pseudomonas
P. aeruginosa

Nomenclature

- **Pseudomonas** = “false unit”
- **aeruginosa** = “blue-green color”

Named due to pigment production

Morphology

- Gram-negative rods
- Motile (flagella)
- Non-spore forming
- Sometimes encapsulated

Environmental Habitat

- **Widely distributed in nature**
- **Found in soil (especially moist and nutrient-rich soils)**
- **Present in water bodies**
- **Thrives in moist environments due to minimal nutritional requirements**
- **Found on plants and vegetation**
- **Capable of forming biofilms on natural surfaces**

Human-associated & Artificial Habitat

- **Part of normal flora (transient) in humans**
- **Common in hospital environments (nosocomial settings)**
- **Found in household moist areas**
- **Forms biofilms on artificial surfaces,**

Nutrient Media Required

1. General Purpose Media

- Nutrient agar / broth
- Blood Agar

2. Selective & Differential Media

- MacConkey Agar
  - Growth as non-lactose fermenting colonies (pale)
- Cetrimide Agar
  - Highly selective
  - Enhances pigment production (pyocyanin, fluorescein)

3. Differential / Indicator Media

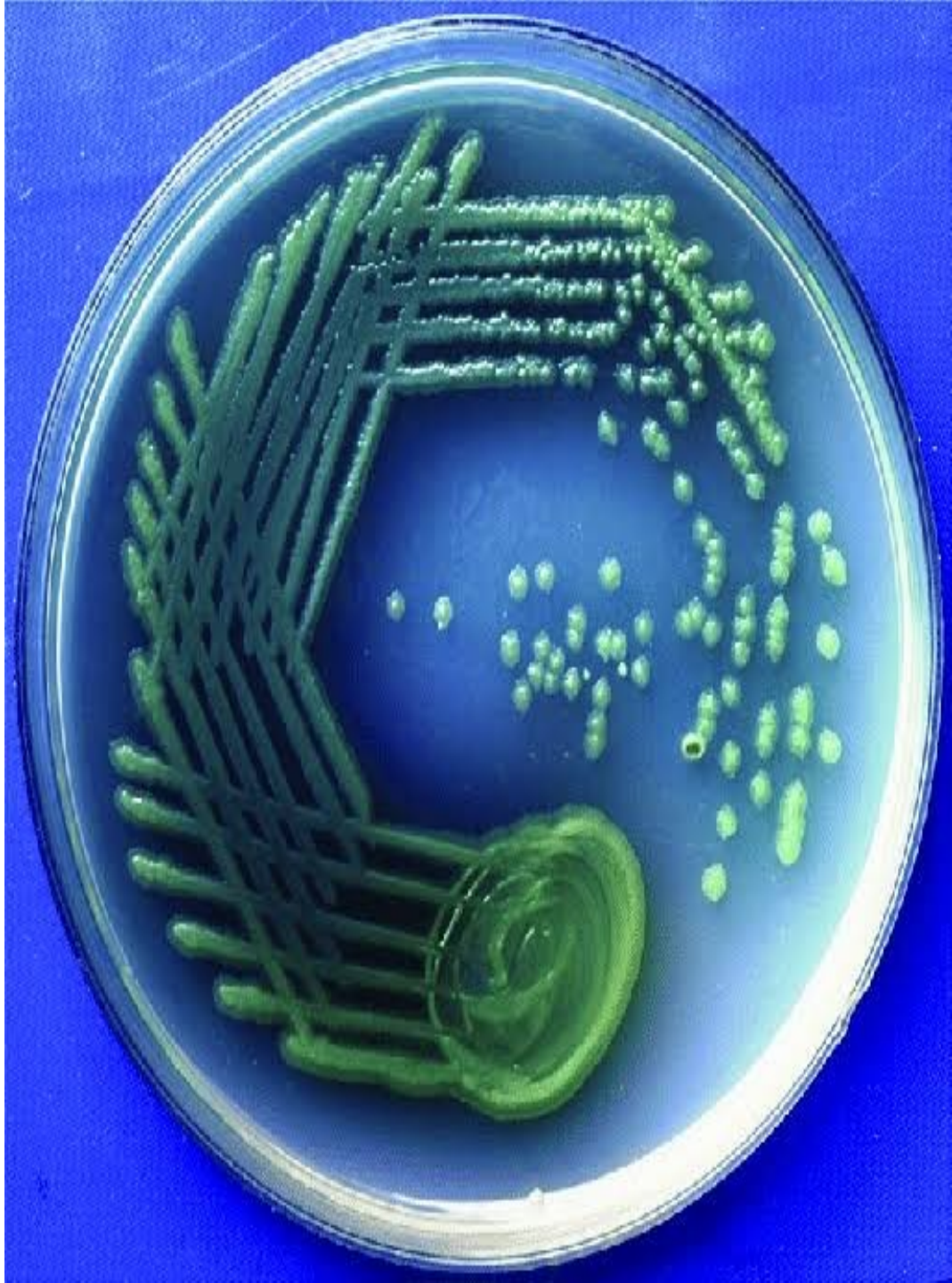
- King's A Medium → enhances Blue-green pigment
- King's B Medium → enhancesYellow-green fluorescence

4. Enrichment & Specialized Media

- Peptone Water
- Minimal media – demonstrates low nutritional requirements
- Can grow in distilled water (high adaptability)

Colony Characteristics

- Large, smooth colonies
- Flat edges, raised center



Pseudomonas aeruginosa
Nutrient agar

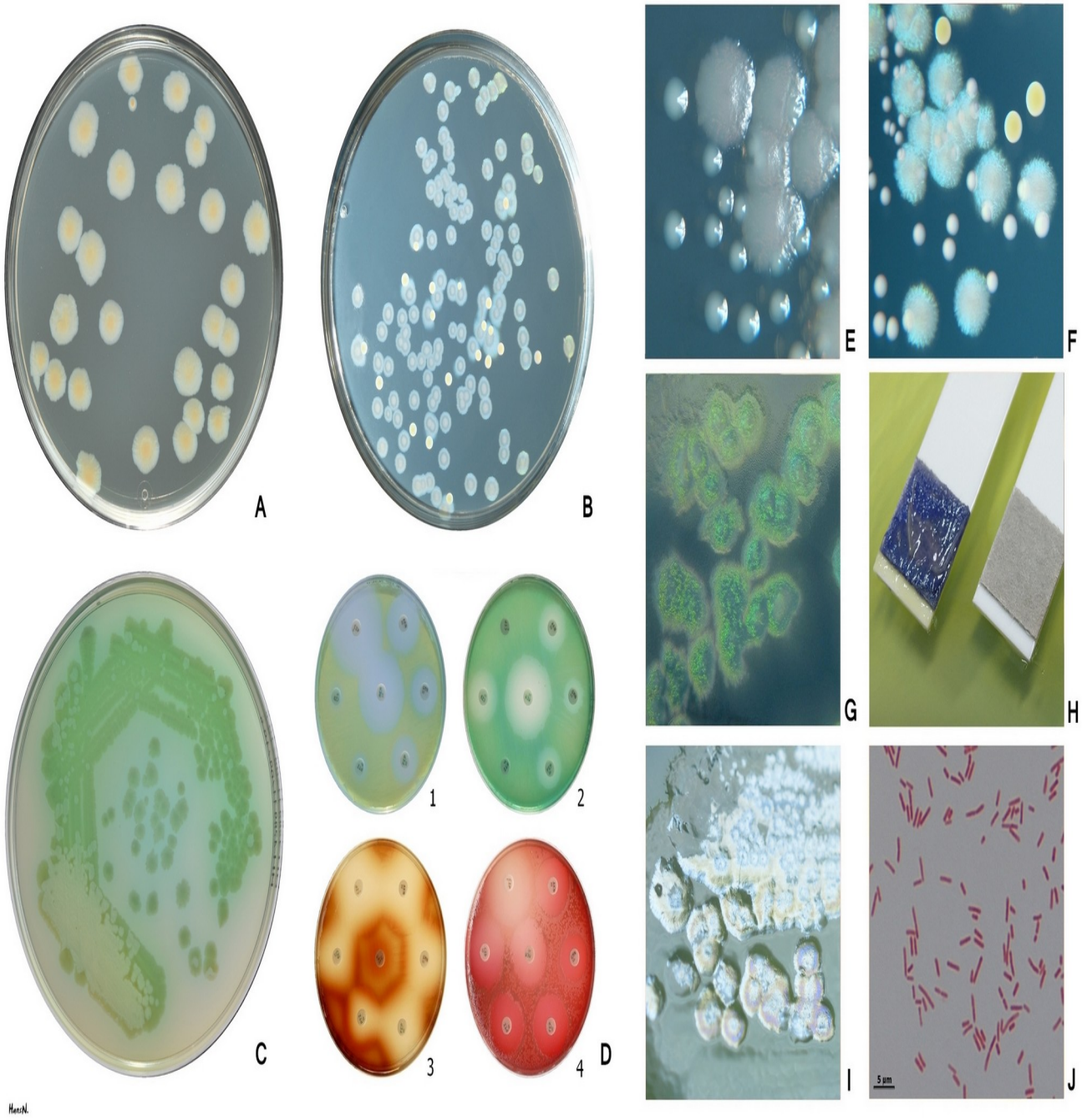
Pigment

Pyoverdine → green

Pyocyanin → blue

Pyomelanin → brown

Pyorubin → red



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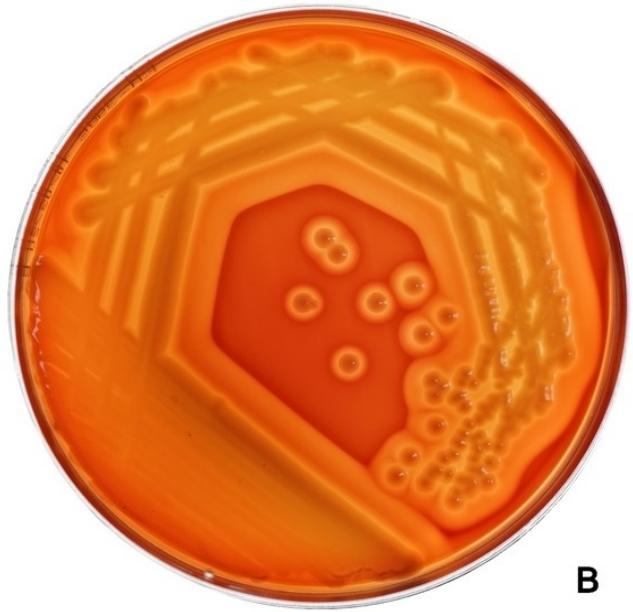

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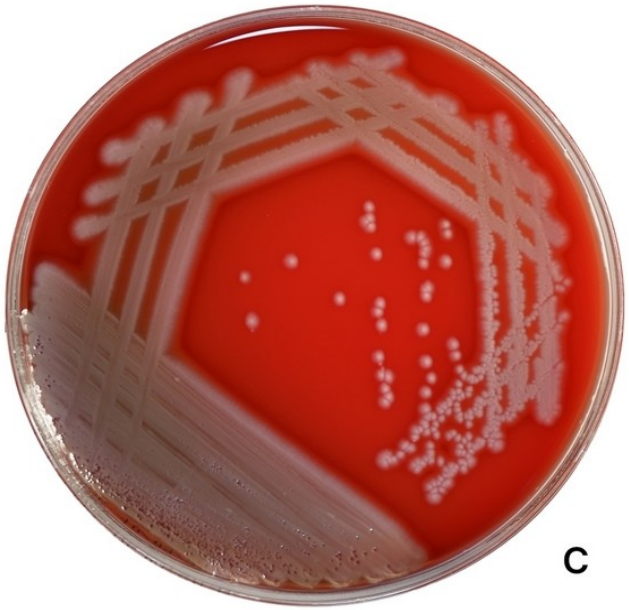

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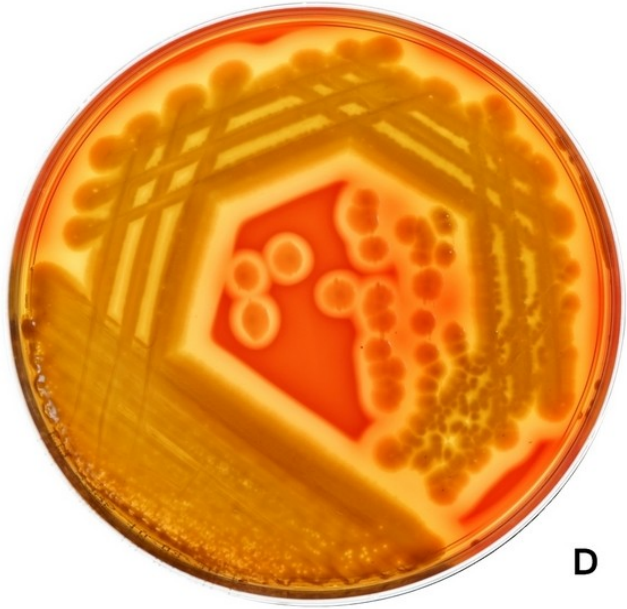

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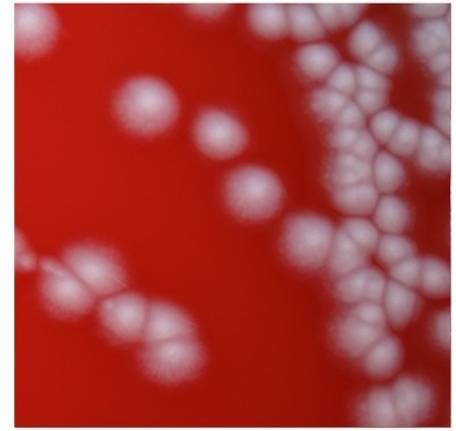

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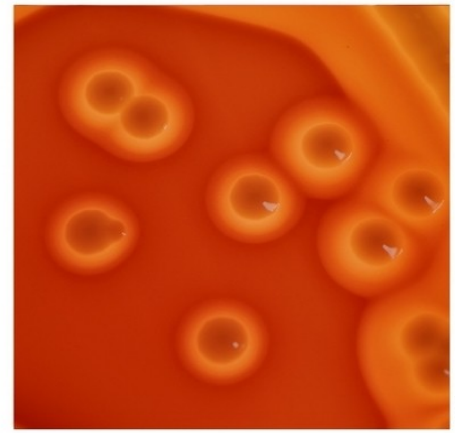

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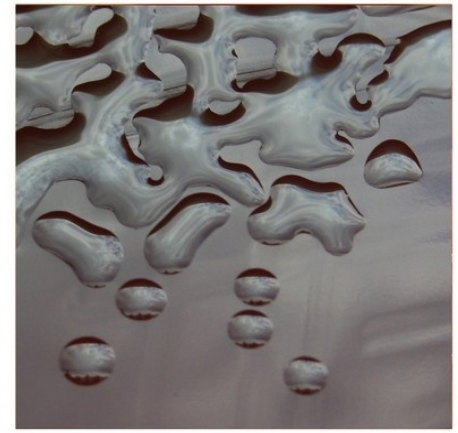

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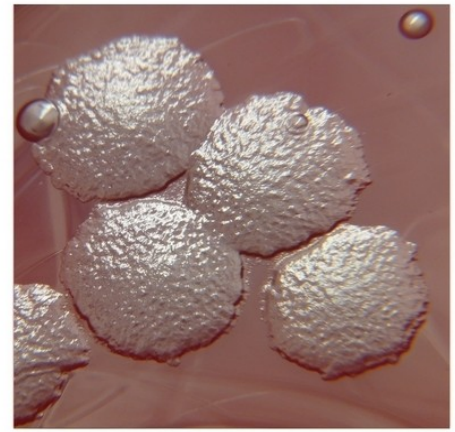

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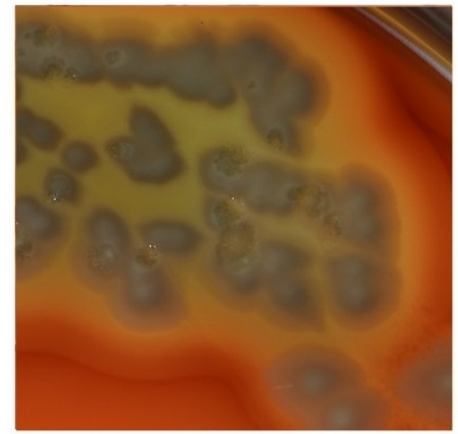

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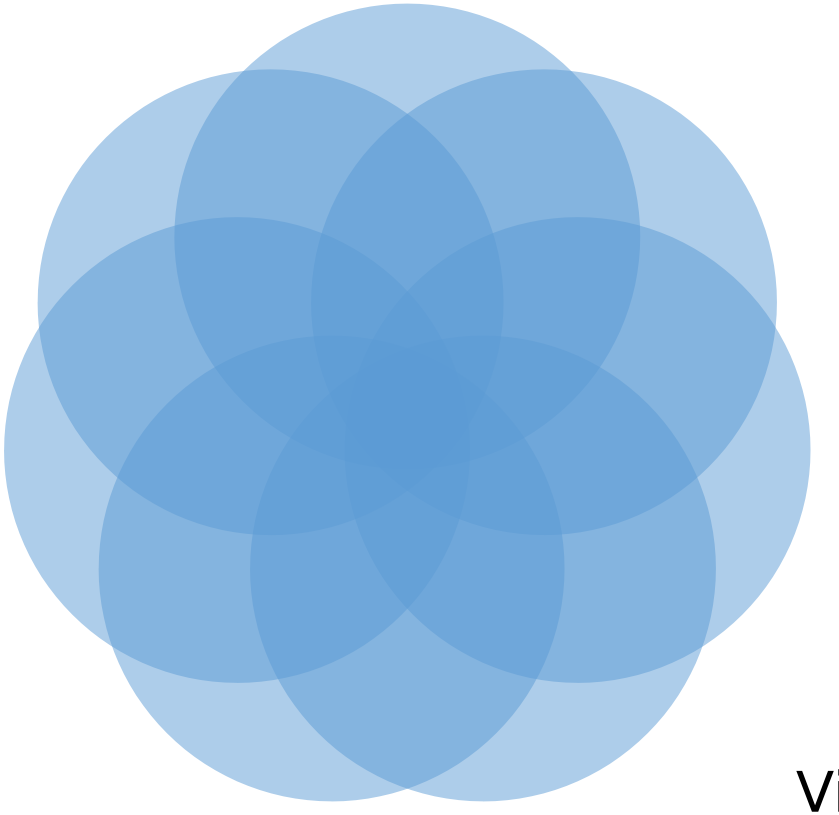
Pseudomonas aeruginosa Produces Various

Adaptation: Enhances survival in diverse environments

Protection: Pigments defend against oxidative stress and environmental damage



Cell communication: Supports quorum sensing and biofilm formation

Iron uptake: Pyoverdine helps capture iron in low-iron conditions

Microbial competition: Inhibits growth of other microorganisms

Virulence: Pyocyanin damages host tissues and produces ROS

Hospital Importance

- Common nosocomial pathogen
- Found in:
  - Catheters
  - Ventilators
  - Medical equipmer
- Causes cross-infec

Pathogenesis

- Opportunistic pathogen
- Infects:
  - Immunocompromised patients
  - Burn victims
  - Cystic fibrosis patients

Virulence Factors

- Exotoxin A → inhibits protein synthesis
- Exoenzyme U → cell destruction
- Pyocyanin → oxidative stress
- Siderophores → iron uptake

Quorum Sensing

- Cell-to-cell communication
- Uses signaling molecules
- Controls:
  - Virulence
  - Biofilm formation

Biofilm Formation

- Forms protective communities
- Resistant to antibiotics
- Found in lungs & medical devices

Role in Chronic Disease

- Common in:
  - Cystic fibrosis
  - Lung infections
- Biofilms make infections persistent

Diseases Caused

- Pneumonia
- Urinary tract infec
- Sepsis
- Wound infections

Pseudomonas

Opportunistic infections

- Hospital settings (moist areas)
- Innate immune deficiency
- Trauma (wounds)

- Antibiotic resistant

Pulmonary

- Tracheobronchitis
- Pneumonia w/ necrosis
- Risk: Cystic fibrosis, Mechanical ventilation

Skin & Soft Tissue

- Burn wounds
- Folliculitis
- Nail infections

Urinary tract infections

- Assoc. w/Indwelling catheters

Osteochondritis

- Puncture wound

Otitis externa

- Mild: Swimmer's ear
- Severe: Diabetics, Elderly

Corneal infections

- Trauma; contact lenses

Bacteremia

- High mortality rate
- Multi-drug resistance; Immunocompromised.
- Ecthyma gangrenosum
  - Necrotic, hemorrhagic lesions

Clinical Features

- Inflammation
- Tissue damage
- Fever
- Severe cases → sepsis

Diagnosis

- Gram stain → Gram-negative rods
- Culture → pigment & odor
- Biochemical tests
- Growth at temp. up to 42°C

Laboratory Identification

- Grows on MacConkey agar (non-lactose fermenter)
- Positive tests:
  - Oxidase +
  - Catalase +
  - Citrate +
- Growth at upto 42°C

Antibiotic Resistance

- Multidrug resistant
- Mechanisms:
  - Efflux pumps
  - β-lactamases
  - Low permeability

Treatment

- Based on culture sensitivity
- Drugs:
  - Aminoglycosides
  - Fluoroquinolones
  - Carbapenems
  - Polymyxins
- Often combination therapy

Prevention & Conclusion

- Proper sterilization
- Hospital hygiene
- Controlled antibiotic use
- Conclusion:
  - Highly adaptable pathogen
  - Major clinical concern due to resistance